



Michigan Recycling Measurement Project:

The Economic Impact of Recycling

Michigan Recycling Coalition

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The Economic Impact of Recycling in Michigan

Summary

Recyclable materials processing has a significant impact on Michigan's economy. Respondents to a survey of recyclable materials processors conducted by the Michigan Recycling Coalition reported \$437 in annual revenue, 1,920 jobs, and over \$52 million in annual payroll attributable directly to processing activities. When extrapolated from the 51 percent of entities who responded to the survey to the entire processing industry in Michigan, this implies total annual revenues of over \$1.9 billion, total employment of 5,028, and a total annual payroll of more than \$137 million.¹ Table 1 summarizes estimates of the direct economic impacts of recyclable materials processing in Michigan.

Economic activity in recyclable materials processing generates additional activity in other sectors that provide goods and services as inputs to processing. This additional activity supports jobs that can be indirectly attributed to recyclable materials processing. Furthermore, workers in processing activities spend their money on other goods and services that support still more economic activity and jobs. Estimating indirect and induced economic impacts associated with recyclable materials processing in Michigan was beyond the scope of this study. Studies in other states in the region, however, suggest that the total economic impact of recyclable materials processing may be twice as large as the direct impact of processing activities.

Introduction

Recycled materials processing in Michigan generates revenue for processing firms and wages for employees. It also gives rise to economic activity in other segments of Michigan's economy that provide goods and services to the processing industry or its employees. To the extent that these economic impacts accrue to Michigan firms or workers, they represent an economic benefit to the state - a benefit that would be absent without the processing activity. One objective of the Michigan Recycling Measurement Study was to estimate the magnitude of economic impacts associated with recycled materials processing in Michigan.

Economic impact studies define three types of economic impacts - direct, indirect, and induced. Direct impacts are those directly related to recycled materials processing. These include the profits of processing firms and wages earned by employees. Firms that process recycled materials also purchase goods and services from other firms (*e.g.*, equipment, office supplies, and electrical power). The additional profits or wages associated with providing these goods and services are *indirect* economic impacts of recycled materials processing. To the extent that these additional impacts accrue to Michigan firms, they represent economic benefits within the state. Finally, workers in the recycled materials processing industry spend their wages on food, cars, homes, and other goods and services and thus induce additional economic activity for the providers of these goods and services. The resulting economic activity is an

¹ Procedures for extrapolating from survey responses to the entire industry are described later in the report.

induced impact of recycled materials processing.

The remainder of this section reviews the economic impact data collected in the survey and reports estimates of the economic impact of recycled materials processing in Michigan. Survey responses provided the data necessary to estimate direct impacts only. Developing the regional economic models necessary to accurately estimate indirect and induced impacts was beyond the scope of this study. The section does, however, review the magnitude of these impacts for other similar studies as an indication of their possible importance in Michigan.

Direct Economic Impacts

The questionnaire asked respondents to report the total number of employees in the firm, the proportion of the work force engaged in processing activities, total firm payroll, total revenue, and the proportion of revenue generated from processing activities. These data described the direct economic activity associated with recycled materials processing for survey respondents. This section reviews survey responses on the revenue, employment, and wages associated with recycled material processing in Michigan. The following section uses these data to estimate direct economic impacts associated with recycled materials processing and extrapolates from the survey data to estimate economic impacts associated with the entire recycled materials processing industry in Michigan - not just the firms who responded to the survey.

Employment and Payroll

Of the 204 firms or organizations that responded to the survey, 142 (70 percent of respondents) provided complete employment and payroll information. To protect sensitive information, the questionnaire solicited responses to employment and financial information in ranges rather than asking for exact numbers.

Most entities that process recycled materials in Michigan are relatively small. Of the 142 respondents who provided complete employment information, 59 percent reported fewer than ten workers and 78 percent reported fewer than 25. Only five respondents (3.5 percent) reported employing 200 or more workers. Similarly, 34 percent of respondents reported a total annual payroll of under \$50,000 and 75 percent reported an annual payroll of less than \$500,000. Just over two percent reported total annual payrolls of \$10 million or more. Tables 2 and 3, respectively, report number of employees and payroll data.

Few respondents focused exclusively on processing recycled materials. Fewer than 20 percent reported spending 90 percent or more of their labor time in processing activities. In contrast, 37 percent reported spending ten percent or less of their labor time in processing activities. Table 4 summarizes responses.

Reported employment in processing activities was estimated as the number of workers employed by a respondent multiplied by the proportion of employees engaged in processing activities summed over all respondents. Total employment in processing activities for the 142 entities that provided complete employment information was 1,920 employees. On average, these entities had 13.5 employees engaged in processing activities.

The 142 respondents that reported complete employment and payroll information attributed a total payroll of \$52,472,750 to workers engaged in processing activities. Total

payroll for processing activities is total reported payroll divided by total employees and then multiplied by the proportion of labor hours attributed to processing activities. The average annual payroll per employee in processing activities is \$27,329.

The employment and payroll figures above represent only those entities that responded to the survey. Overall, 204 of the 406 entities contacted for the survey ultimately completed and returned the questionnaire for a response rate of 50 percent. Thus the employment and payroll figures reported by respondents represent only a portion of the total economic activity associated with recyclable materials processing in the state. The analysis used survey responses to develop best guess estimates of economic activity for the entire processing industry. Appendix A details procedures used to calculate extrapolation multipliers for recycled quantities.

The extrapolation multiplier for employment and payroll was calculated as the proportion of respondents who reported employment data who also reported processing material (.82) multiplied by the sample size (406) and divided by the number of respondents who reported employment and payroll data and also processed material (128). The extrapolation factor for employment and payroll is 2.619. Estimated employment in processing recyclable material in Michigan in 2000 was thus 5,028 employees. Estimated total payroll was \$137,426,132.

The employment and payroll estimates obtained in this study are quite close to estimates from another recent study of the economic impact of recycling activity in Michigan (Fridgen et al., 2000). The authors of that study estimated employment of 5,647 and total wages of \$197 million.

Revenue

The questionnaire also asked respondents to report total revenue and the proportion of revenue from processing activities. As with the employment and payroll questions, the questionnaire solicited responses in ranges rather than asking for exact numbers. Respondents were somewhat sensitive about reporting revenue figures and only 89 gave complete responses. Tables 5 and 6 summarize responses for those who answered the revenue questions.

Most respondents obtained either very little or most of their revenue from processing activities. Almost 30 percent of respondents who reported complete revenue data reported obtaining between 90 and 100 percent of their revenue from processing activities. At the other extreme, almost 25 percent reported obtaining less than ten percent of their annual revenue from processing activities. This concentration at both ends of the distribution suggests that the majority of entities that process recyclable materials are either very specialized or very diverse.

Total revenue was calculated by multiplying revenue by the proportion of revenue from processing for each respondent and then summing across respondents. Total revenue generated from processing activities in Michigan was \$437 million.

Financial and employment estimates must also be extrapolated from the sample to the entire industry in Michigan. The extrapolation multiplier for the revenue data was calculated as the proportion of firms responding to the revenue question who also reported processing recyclable material (.77) multiplied by the total number of firms in the sample (406) and then divided by the total number of firms that provided revenue data and processed material (70). The extrapolation factor for revenue is 4.466. Estimated revenues from the processing of commercial/residential recyclable material in Michigan was thus \$1,952 million.

Indirect and Induced Economic Impacts

The indirect and induced impacts associated with an activity are generally estimated from input output tables. Input output tables show the flow of goods and services between industries where industries are defined by Standard Industrial Classification (SIC) categories. For example, recyclable materials processors purchase machinery from machinery manufacturers who in turn purchase raw materials, parts, and services from other industries. Similarly, recyclable materials processors provide processed feedstock to other manufacturers who then sell their product to other manufacturers and to consumers. An input output table shows the monetary value of the flow of goods and services between these industries. Input output tables can be national or regional in scope. A regional input output table shows the flow of goods and services between industries in a defined geographic region. Thus, if recyclable materials processors purchased machinery from manufacturers in Arizona, the value of the purchases would appear on a national input output table but not on a regional (Michigan) table.

Analysts use input output tables to estimate national or regional multipliers. Regional multipliers for an industry indicate the indirect and induced revenue and jobs associated with each dollar in revenue or each job in the industry of interest. Thus, a multiplier for total economic impact for recyclable materials processing indicates the total indirect and induced jobs associated with each job in the processing industry.

Input output tables are very difficult to construct - particularly at the regional level. Furthermore, analysis from published input output tables can be reliably applied only to industries that appear in the tables - those defined by the SIC system. Most of the industries that process recyclable materials are not included separately in the SIC system. The only ways to estimate indirect and induced economic impacts for these industries is to construct input output tables for these industries - a task that is beyond the scope of this study - or to assume they are similar to other industries that are included in the tables.

At least two other studies of the economic impact of recycling activities estimated indirect and induced impacts of recycling. Actual impacts within a region will depend on the composition of the recyclable materials processing industry and the composition of other industries in the region. Thus, estimates of these impacts from other regions are not directly applicable to Michigan. They do, however, provide an indication of the magnitude of indirect and induced benefits in other regions and indicate the range within which these impacts might fall in Michigan.

In Wisconsin, researchers estimated multipliers by matching recyclable materials processing industries to similar industries that were included in regional input output tables (citation). They estimated a multiplier for the entire processing industry of 2.65. This means that every job in the recyclable materials processing industry generated 1.65 indirect and induced jobs in other industries. Researchers in Iowa took a similar approach and estimated a multiplier of 2.00 implying that each job in recyclable materials processing created one job elsewhere in the region (citation). While these estimates are not directly applicable to Michigan, they do illustrate that the direct economic impacts of recyclable materials processing may be a relatively small portion of total economic impacts.

Appendix A: Extrapolating Sample Data to Michigan's Recycling Industry

Those who responded to the Michigan Recycling Measurement Survey represented only a portion of all recyclable materials processors in Michigan. To estimate the magnitude of recycling activity in Michigan, survey results must be extrapolated from the sample of respondents to the entire recyclable materials processing industry. Usually, such extrapolation is based on information about how well those who responded to the survey represent those who did not. Very little information exists, however, to determine either the number of recycled material processors in Michigan or differences between survey respondents and those who did not respond.

To extrapolate from the respondent sample to the entire recyclable materials processing industry in Michigan, this study relied on two key assumptions. The first is that the mailing list for the survey was complete. That is, it represents all processors of recycled materials in Michigan. The second assumption is that there is no systematic difference between firms who responded to the survey and those who did not respond. Experts for three key materials - metals, paper, and plastics - were consulted to check on the validity of these assumptions. These experts' input was used to modify the extrapolation procedures as described below.

Based on the two assumptions above, extrapolation factors were calculated for each material in the following manner. First, the number of firms in Michigan that handled a particular material was determined from the MRC database. This number was assumed to represent all firms in the state that handled the material (*handled* means either processing the material or passing it through to a broker or processor without processing). Second, survey results were used to calculate the number of responding firms that *handled* each material and the number that *processed* each material. Third, the proportion of responding firms that processed a particular material was calculated as the number of responding firms that *handled* the material divided by the number of responding firms that *processed* the material. Applying this proportion to the total number of firms in Michigan that handled the material yields an estimate of the number of firms in Michigan that processed the material. Dividing this estimate by the number of responding firms that reported processing the material yields the extrapolation factor for that material. Table 1 reports the calculation of extrapolation factors for each material.

Table 1. Calculation of Extrapolation Factors by Material Class

Material	MI firms that handle	Respondents that handle	Respondents that process	Proportion that process	Extrapolation factor
Paper	76	70	52	.743	1.086
Glass	34 ^a	36	21	.583	1.000
Metals	140	63	27	.429	2.222
Plastics	69	47	19	.404	1.468
Organics	145	103	96	.932	1.408
Other	21 ^a	34	27	.794	1.000

- a. The number of respondents who reported handling these materials exceeded the number thought to handle the material. The number of MI firms thought to handle the material was thus set equal to the number of respondents who reported handling the material.

Table 1. Summary of Economic Impacts of Recyclable Materials Processing in Michigan

Impact	Survey respondents only	MI processing industry
Employment	1,920 jobs	5,028 jobs
Payroll	\$52,472,750	\$137,426,132
Revenue	\$437 million	\$1,952 million

Table 2. Number of Employees Reported by Survey Respondents

Number of employees		Responses	
Response range	Midpoint of range ^a	Number	Percent
0 to 9	5	84	59.2
10 to 24	17	27	19.0
25 to 49	37	14	9.9
50 to 99	75	7	4.9
100 to 199	150	5	3.5
200 to 299	250	1	.7
300 to 399	350	1	.7
400 to 499	450	1	.7
500 to 1,000	750	1	.7
2,500 ^b	2,500	1	.7

- a. The midpoint of the response range was used to calculate averages and totals.
- b. Represents an actual response rather than a response range.

Table 3. Total Payroll Reported by Survey Respondents

Total payroll		Responses	
Response range	Midpoint of range ^a	Number	Percent
\$0 to \$49,999	\$25,000	49	34.5
\$50,000 to \$149,999	\$100,000	31	21.8
\$150,000 to \$499,999	\$325,000	27	19.0
\$500,000 to \$999,999	\$750,000	12	8.5
\$1,000,000 to \$2,499,999	\$1.75 million	14	9.9
\$2,500,000 to \$4,999,999	\$3.75 million	2	1.4
\$5,000,000 to \$9,999,999	\$7.5 million	4	2.8
\$10,000,000 to \$19,999,999	\$15 million	1	.7
\$20,000,000 to \$29,999,999	\$25 million	1	.7
\$30,000,000 and more	\$30 million	1	.7

a. The midpoint of the response range was used to calculate averages and totals.

Table 4. Proportion of Workforce Engaged in Processing Activities

Number of employees		Responses	
Response range	Midpoint of range ^a	Number	Percent
0 to 9 percent	5 percent	52	36.6
10 to 19 percent	15 percent	17	12.0
20 to 29 percent	25 percent	10	7.0
30 to 39 percent	35 percent	5	3.5
40 to 49 percent	45 percent	2	1.4
50 to 59 percent	55 percent	5	3.5
60 to 69 percent	65 percent	8	5.6

70 to 79 percent	75 percent	5	3.5
80 to 89 percent	85 percent	10	7.0
90 to 100 percent	95 percent	28	19.7

a. The midpoint of the response range was used to calculate averages and totals.

Table 5. Total Revenue Reported by Survey Respondents

Total revenue		Responses	
Response range	Midpoint of range ^a	Number	Percent
\$0 to \$99,999	\$50,000	15	16.9
\$100,000 to \$249,999	\$175,000	6	6.7
\$250,000 to \$499,999	\$375,000	11	12.4
\$50,000 to \$999,999	\$750,000	14	15.7
\$1,000,000 to \$2,499,999	\$1,750,000	10	11.2
\$2,500,000 to \$4,999,999	\$3,750,000	11	12.4
\$5,000,000 to \$7,499,999	\$6,250,000	5	5.6
\$7,999,999 to \$9,999,999	\$8,750,000	2	2.2
\$10,000,000 to \$19,999,999	\$15,000,000	7	7.9
\$20,000,000 to \$49,999,999	\$35,000,000	3	3.4
\$50,000,000 to \$74,999,999	\$62,500,000	2	2.2
\$75,000,000 to \$99,999,999	\$87,500,000	1	1.1
\$100,000,000 and more	\$100,000,000	0	0.0
Other		2	2.2

a. The midpoint of the response range was used to calculate averages and totals.

Table 6. Proportion of Revenue from Processing Activities

Proportion of revenue		Responses	
Response range	Midpoint of range ^a	Number	Percent
0 to 9 percent	5 percent	21	23.6
10 to 19 percent	15 percent	10	11.2
20 to 29 percent	25 percent	6	6.7
30 to 39 percent	35 percent	4	4.5
40 to 49 percent	45 percent	1	1.1
50 to 59 percent	55 percent	3	3.4
60 to 69 percent	65 percent	5	5.6
70 to 79 percent	75 percent	4	4.5
80 to 89 percent	85 percent	9	10.1
90 to 100 percent	95 percent	26	29.2

a. The midpoint of the response range was used to calculate averages and totals.